

The accumulation of sedimentary PCBs in bullfrog (*Rana catesbeiana*) tadpoles from the Upper Hudson River

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Study Objectives

- Screening level survey of PCB contamination
- Preliminary measure for basing future investigations



Bullfrog Ecology

- Largest North American frog
- Native to Central and Eastern United States
- Highly aquatic
- Carnivorous
- Long lived (up to 10 yrs)
- Breed during late Spring in permanent water bodies
- Egg masses attached to submerged vegetation



Bullfrog Life Stages

Metamorph

Hind Limb

Limb Bud

Frog Spawn

Pre-limb



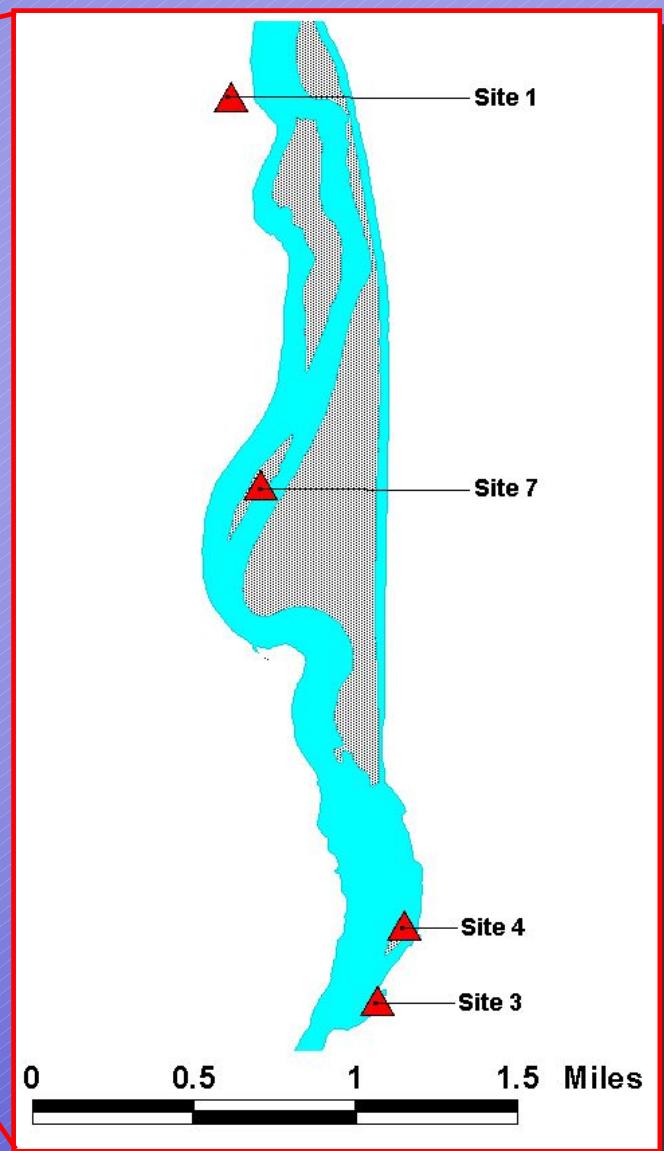
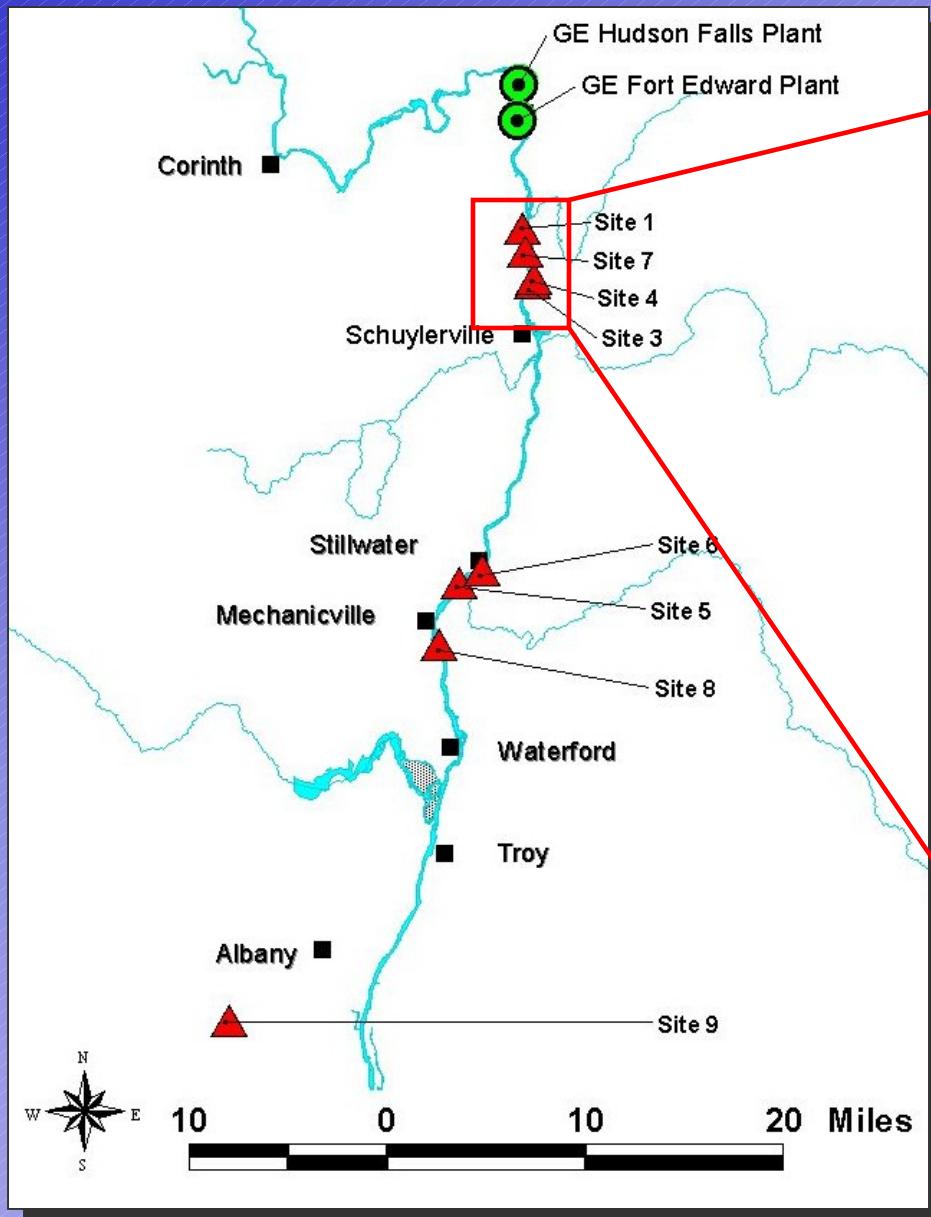
*Gosner KL (1960) A simplified table for staging anuran embryos and larvae with notes on identification. Herpetologica 16: 183-190.

Bullfrog Tadpoles

- Hatch out in Summer
- Over winter in sediments
- May reach lengths greater than 8 cm
- Primarily herbivorous – organic debris, algae, plant tissue, detritus



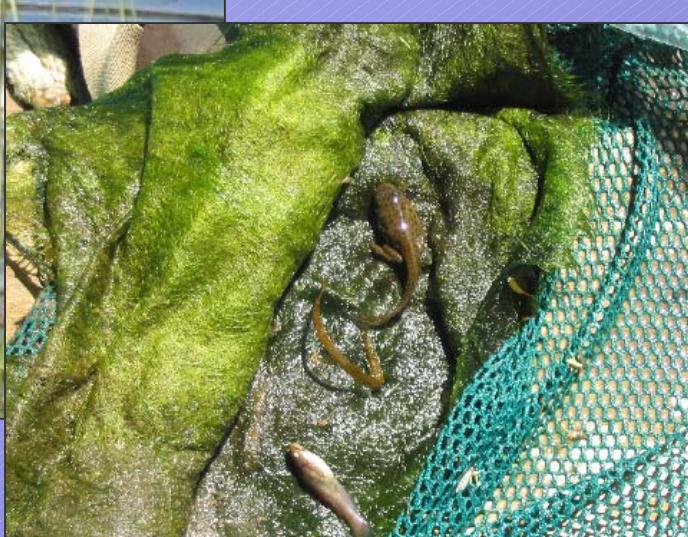
Study Sites



Sampling Synopsis

- Samples collected August-September 2003
- Sediment collected from 9 sites (2 reference)
- Composited sediment samples ($n = 9$)
- 155 tadpoles collected from 8 sites (6 study, 2 reference)
- Individuals were composited based on developmental stage (42 composited samples, $n = 1 - 12$)
- Tadpole gut coils were removed prior to analysis

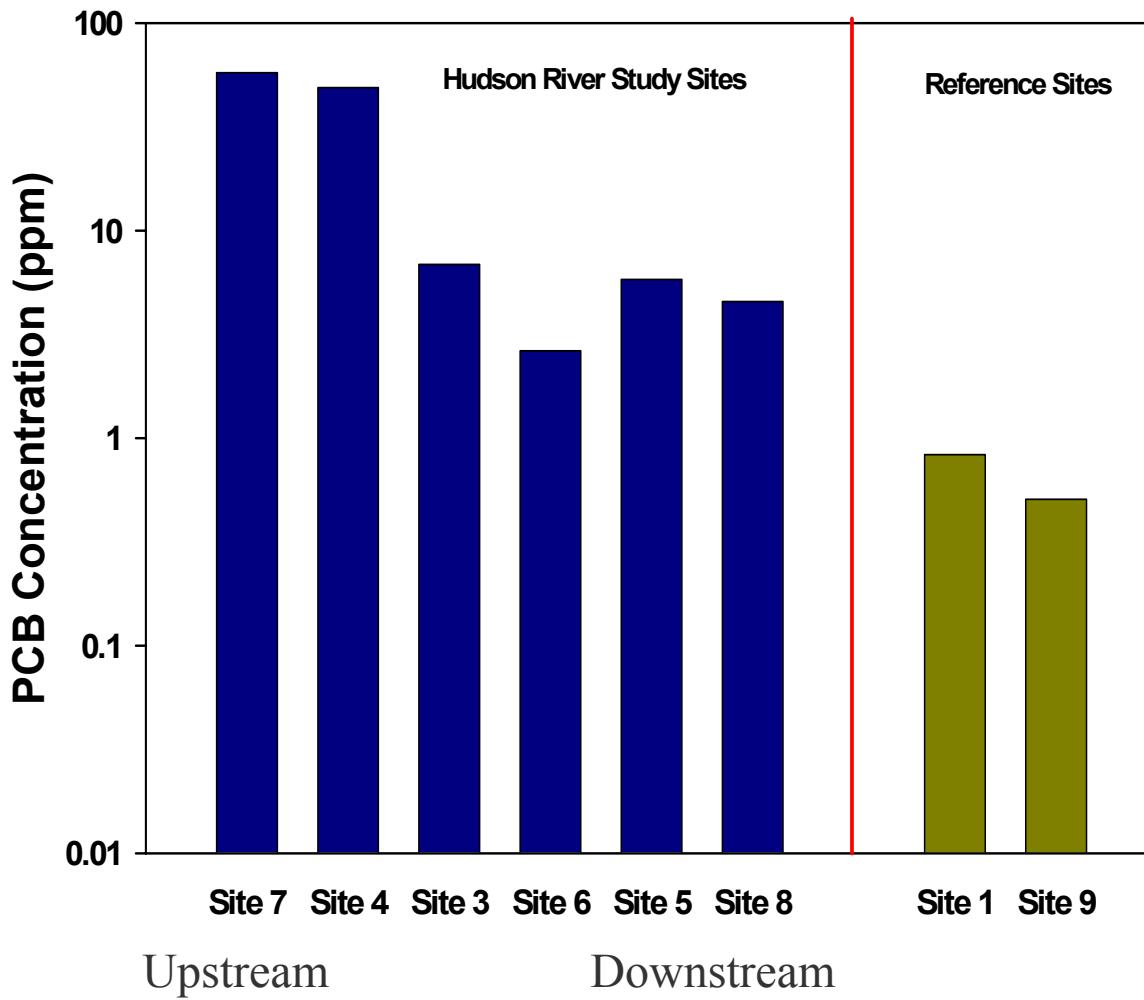
Sampling



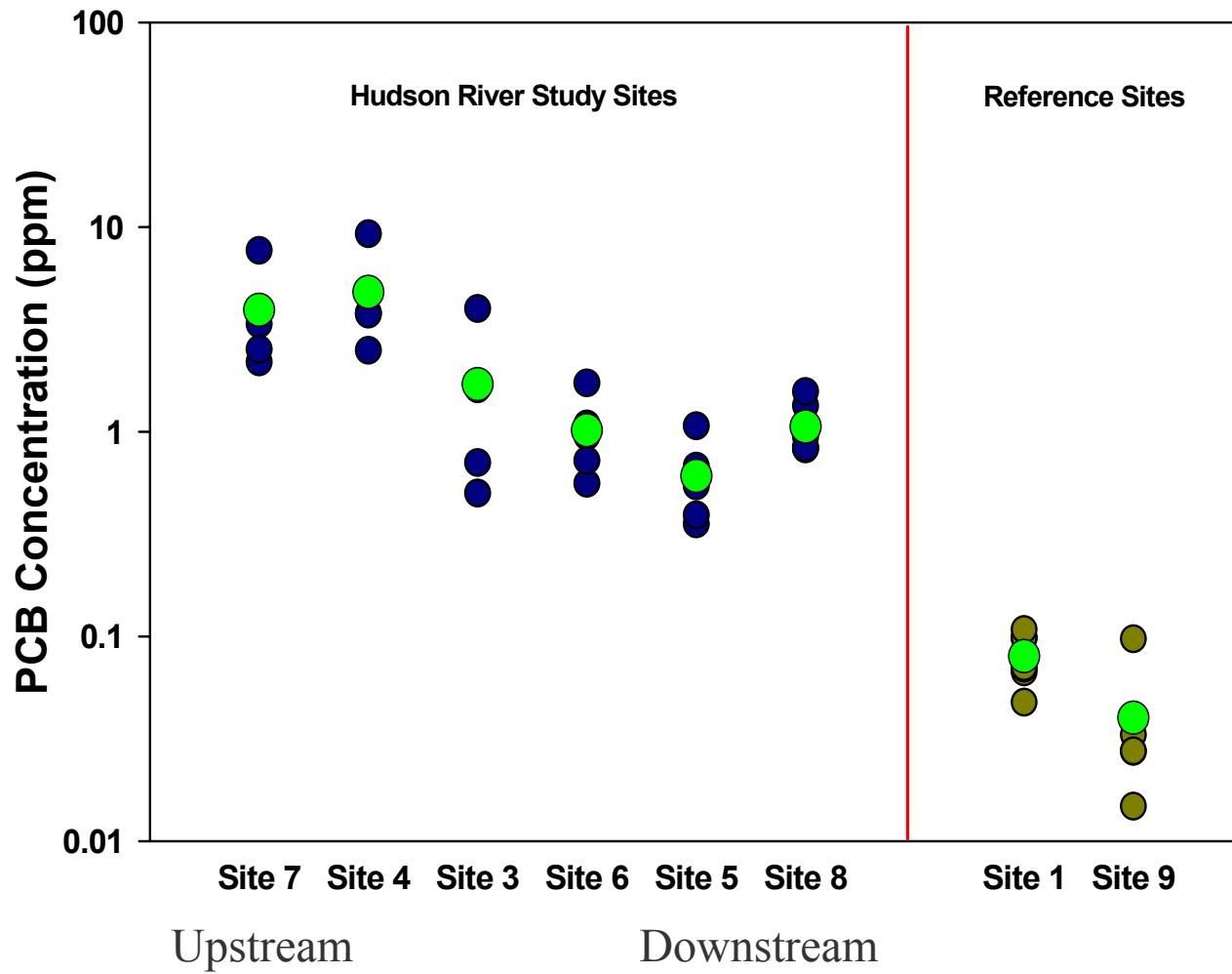
Total PCBs



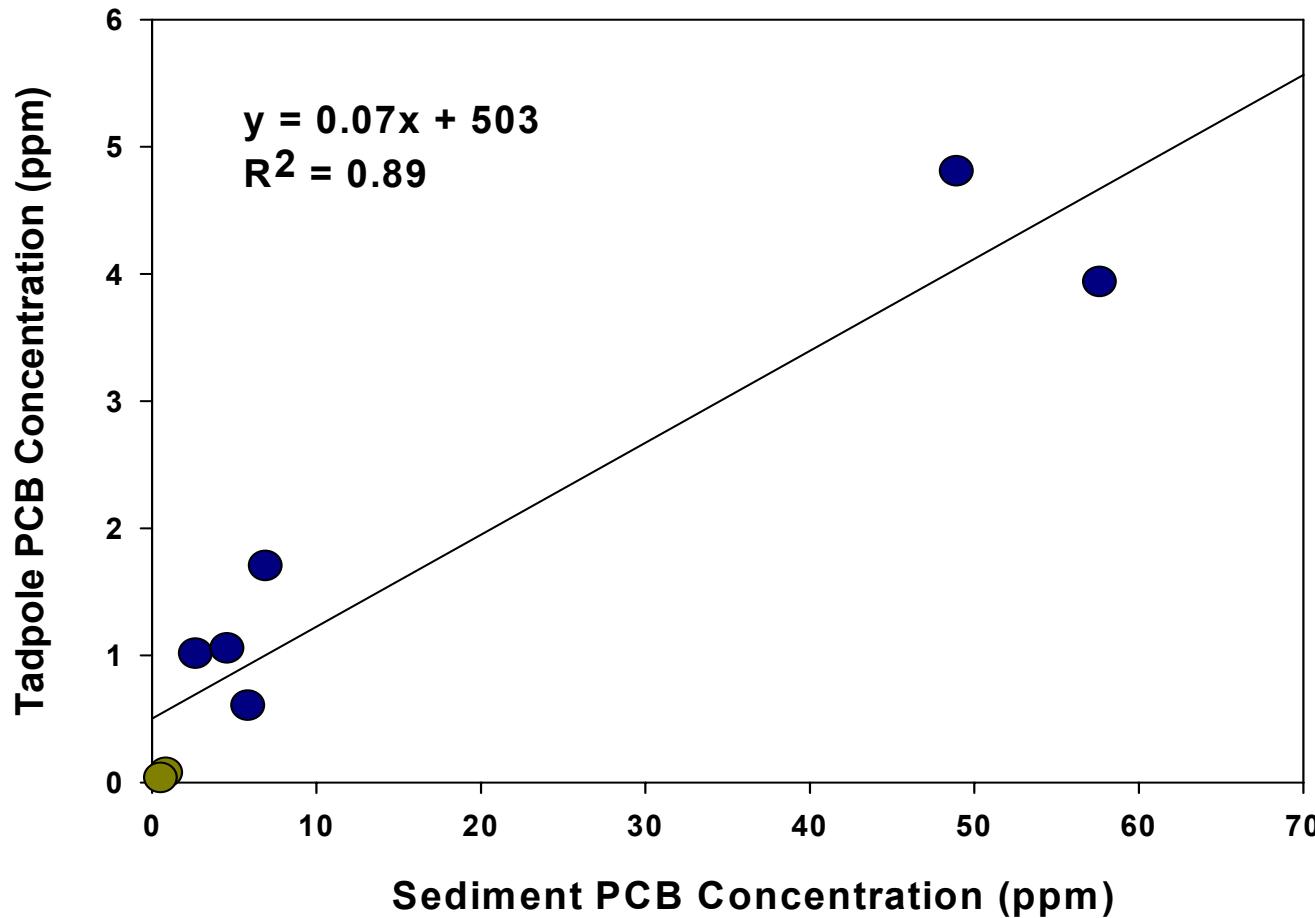
Sediment [PCB]



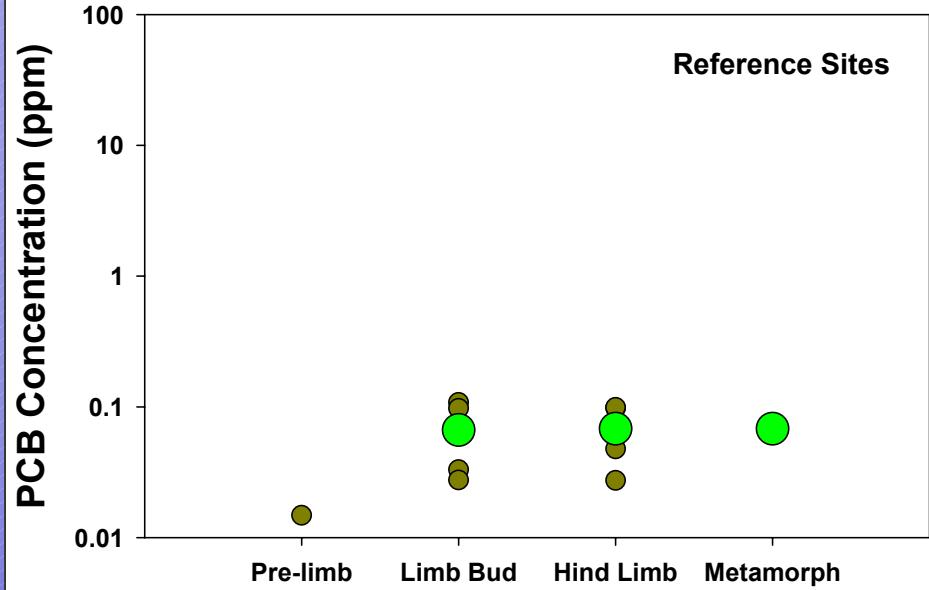
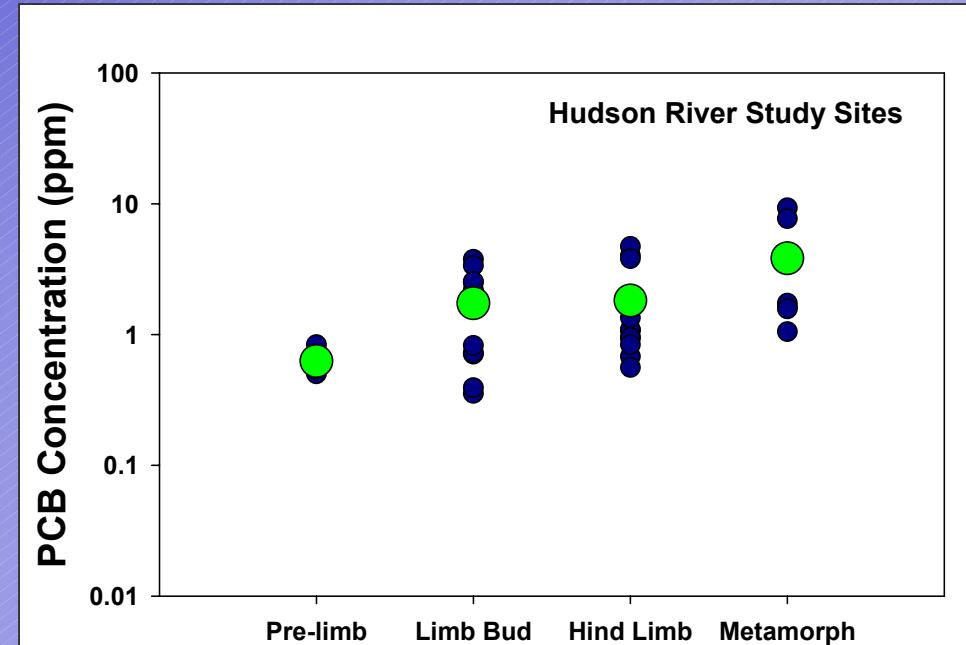
Tadpole [PCB]



Sediment & Tadpoles

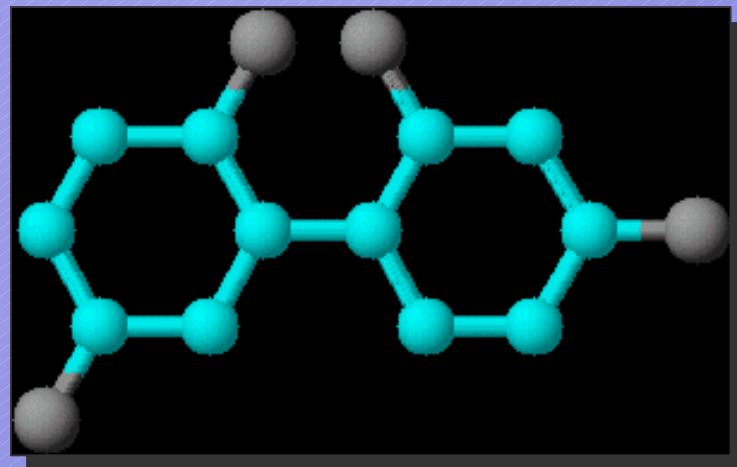


Tadpole Developmental Stage [PCB]



PCB Congeners

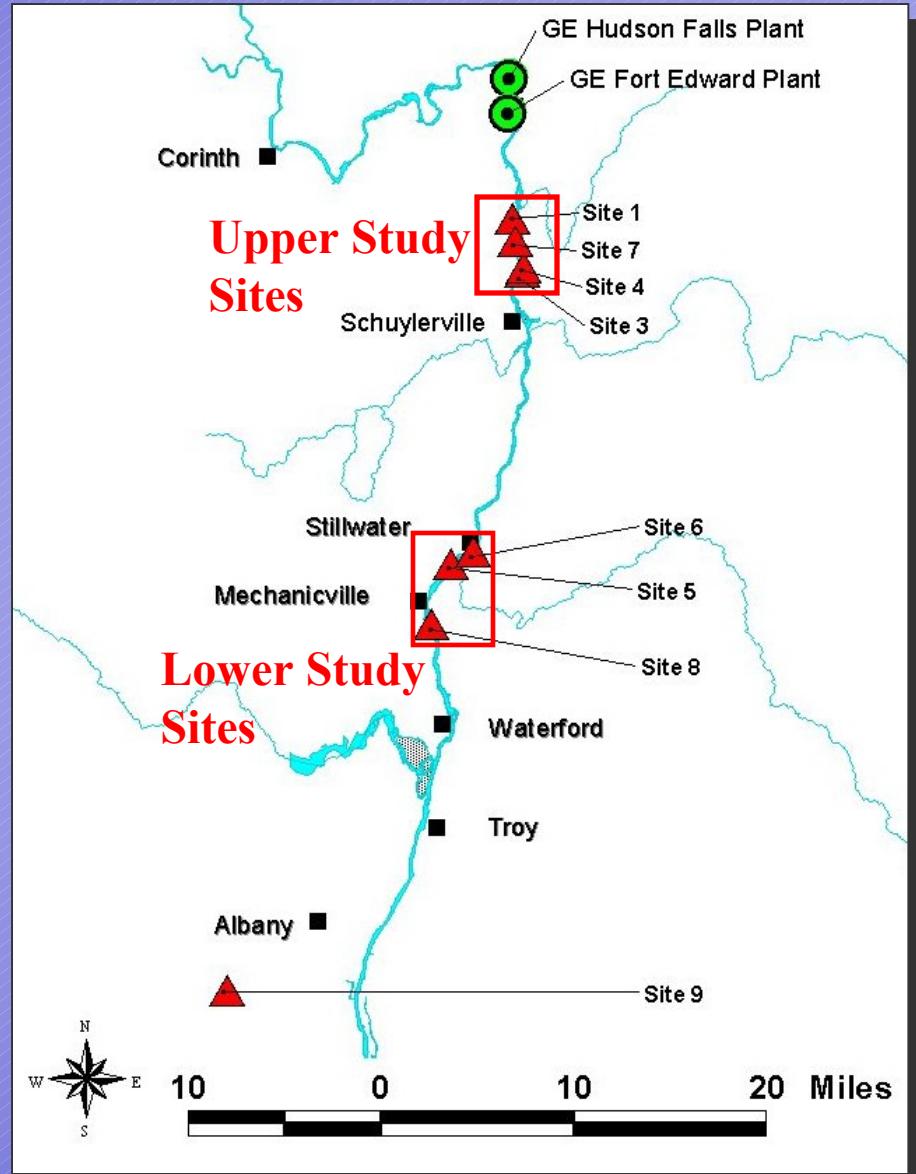
- 48 PCB congeners selected for quantification
- Selected congeners are found, historically, in PCB composition of various Hudson River physical and biological samples
- 12 ‘Dioxin-like’ PCB congeners included among the 48



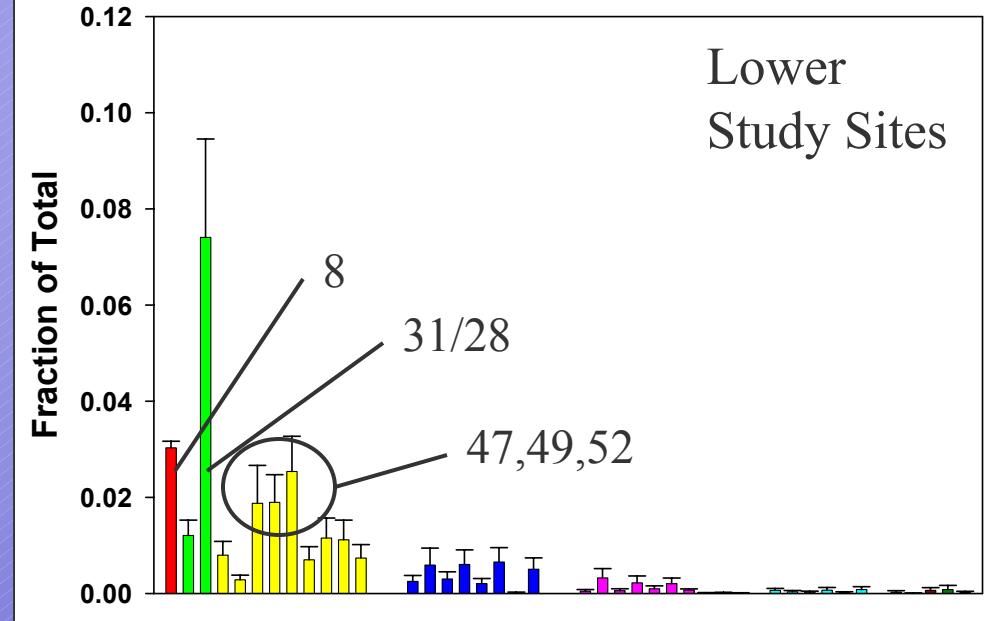
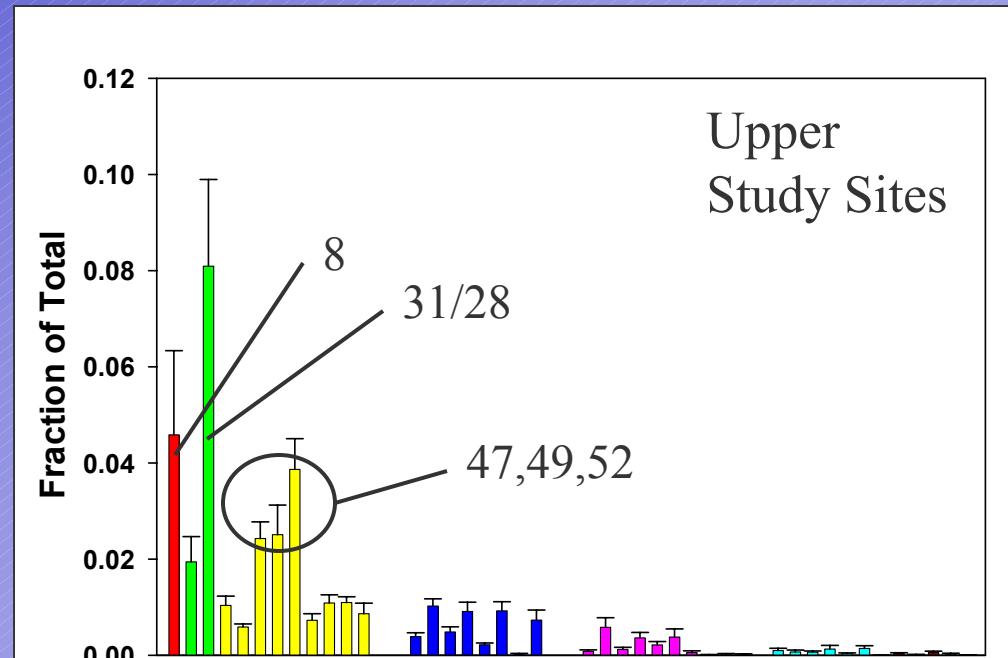
PCB Congeners

<u>Di</u>	<u>Tri</u>	<u>Tetra</u>	<u>Penta</u>	<u>Hexa</u>	<u>Hepta</u>	<u>Octa</u>	<u>Nona</u>	<u>Deca</u>
8	18	44	87	128	170	194	206	209
31/28		45	95	138	174	195		
		47	99	146	177	201		
		49	101	149	180			
		52	105	151	183			
		56	110	153	187			
		66	114	156	189			
		70	118	157				
		74	123	158				
		77	126	167				
		81		169				

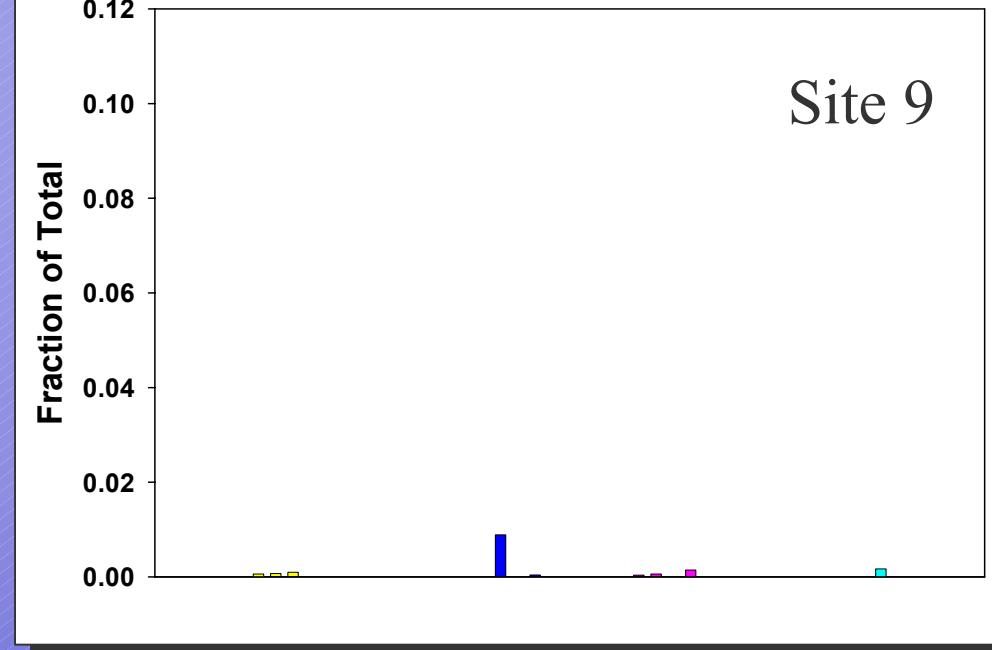
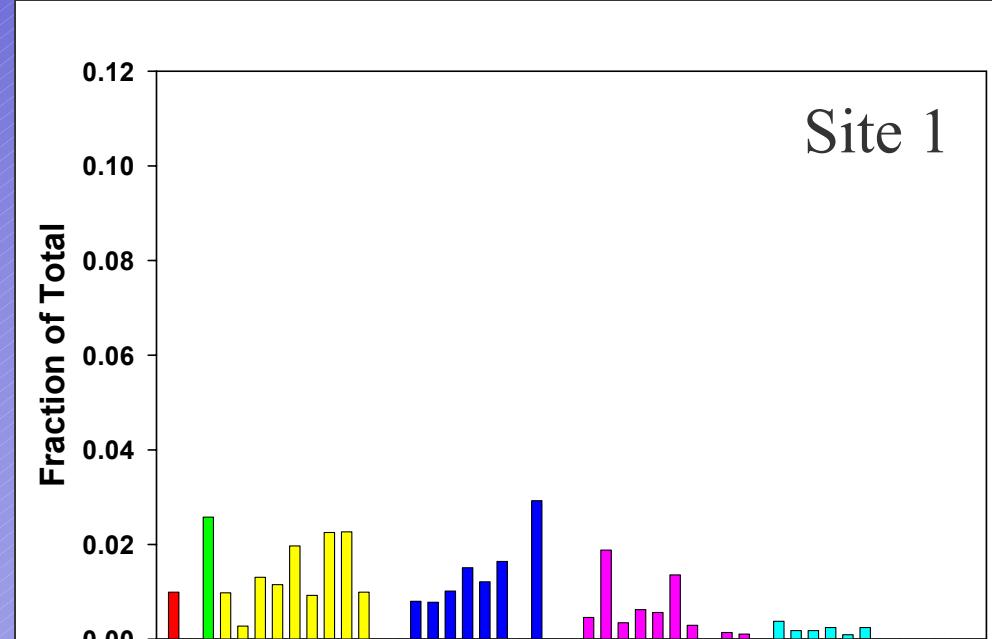
PCB Congeners



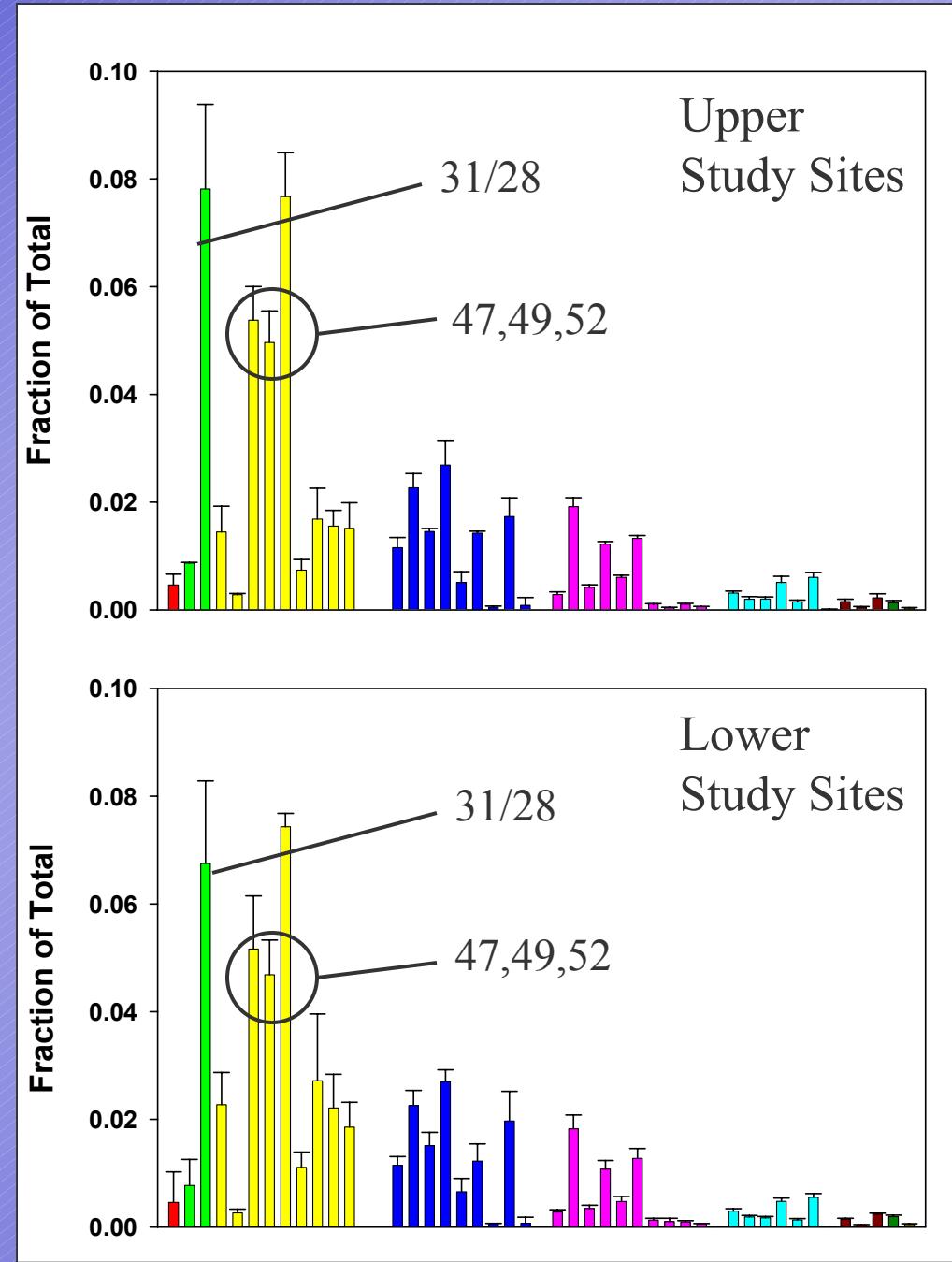
Hudson River Study Site Sediment PCB Congener Composition



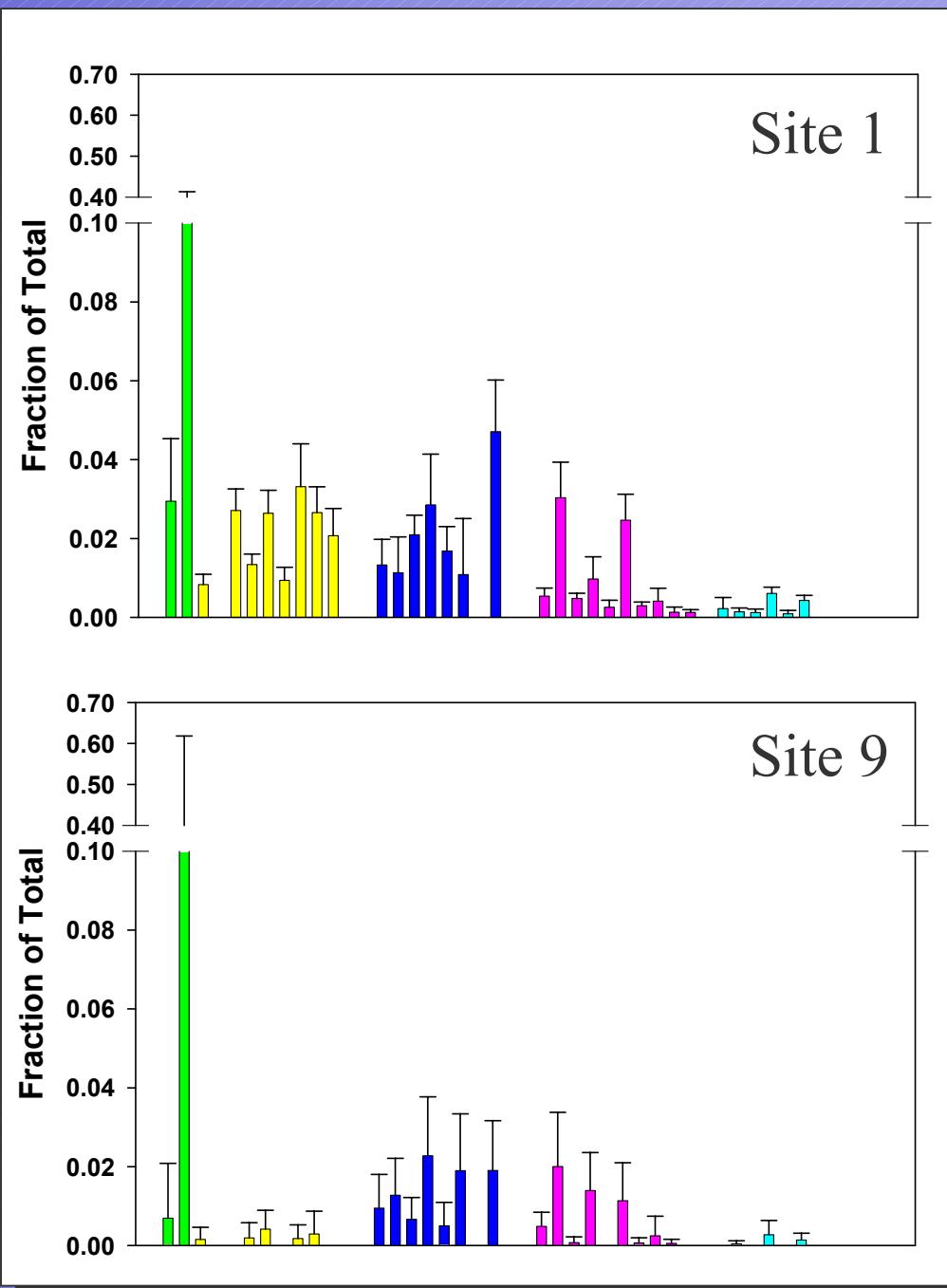
Reference Site Sediment PCB Congener Composition



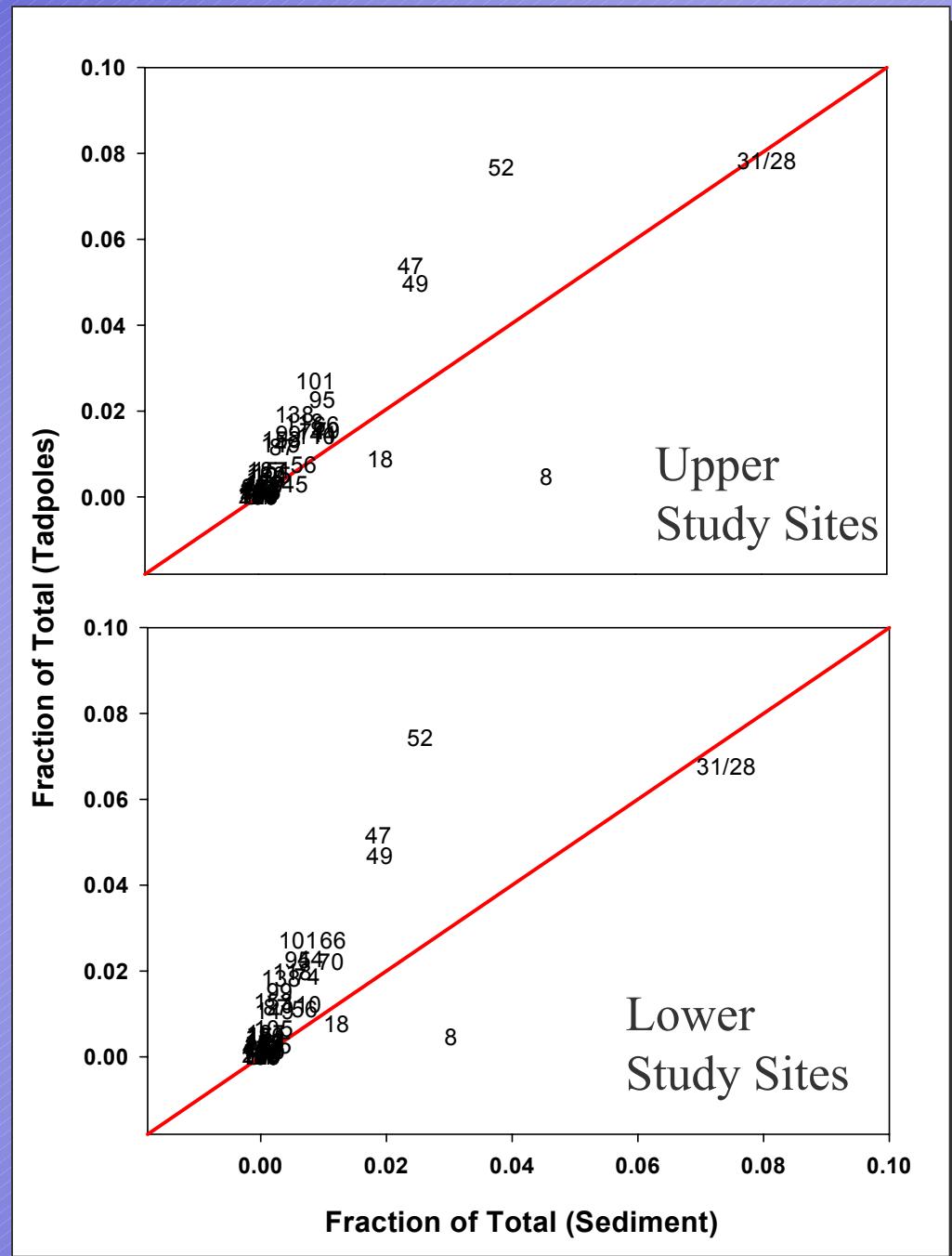
Hudson River Study Site Tadpole PCB Congener Composition



Reference Site Tadpole PCB Congener Composition



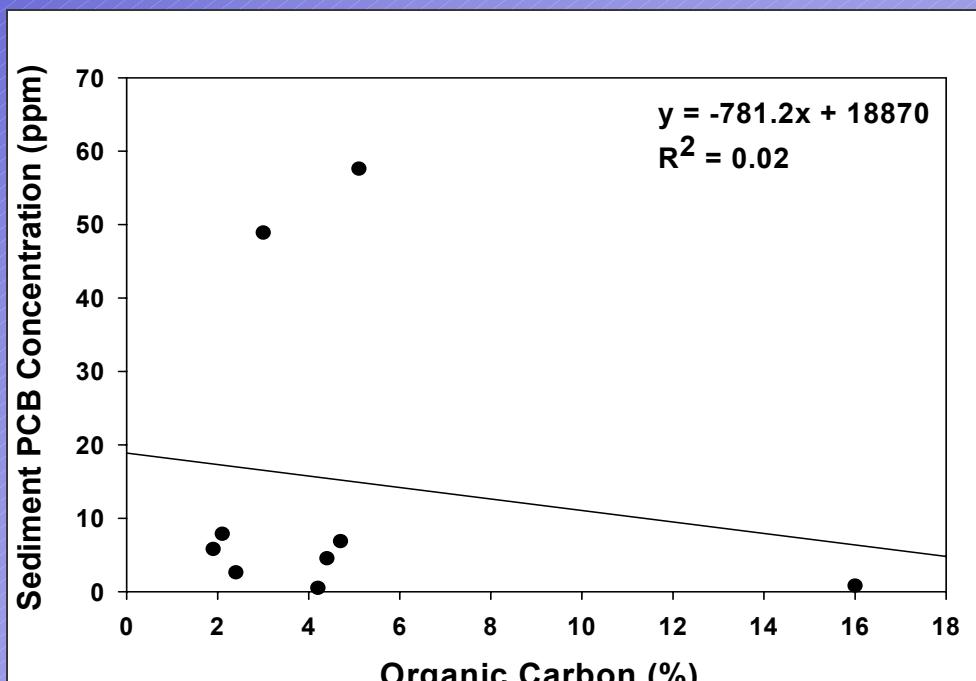
Sediment vs Tadpole PCB Composition (One to One)



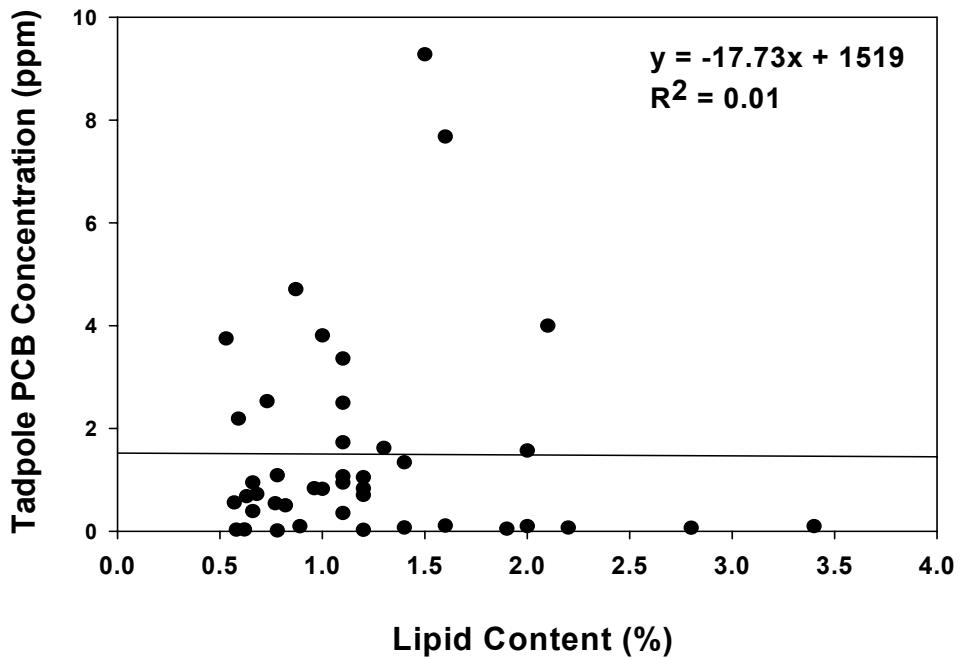
Tadpole : Sediment Ratios (TSRs)



Sediment Organic Carbon vs [PCB]



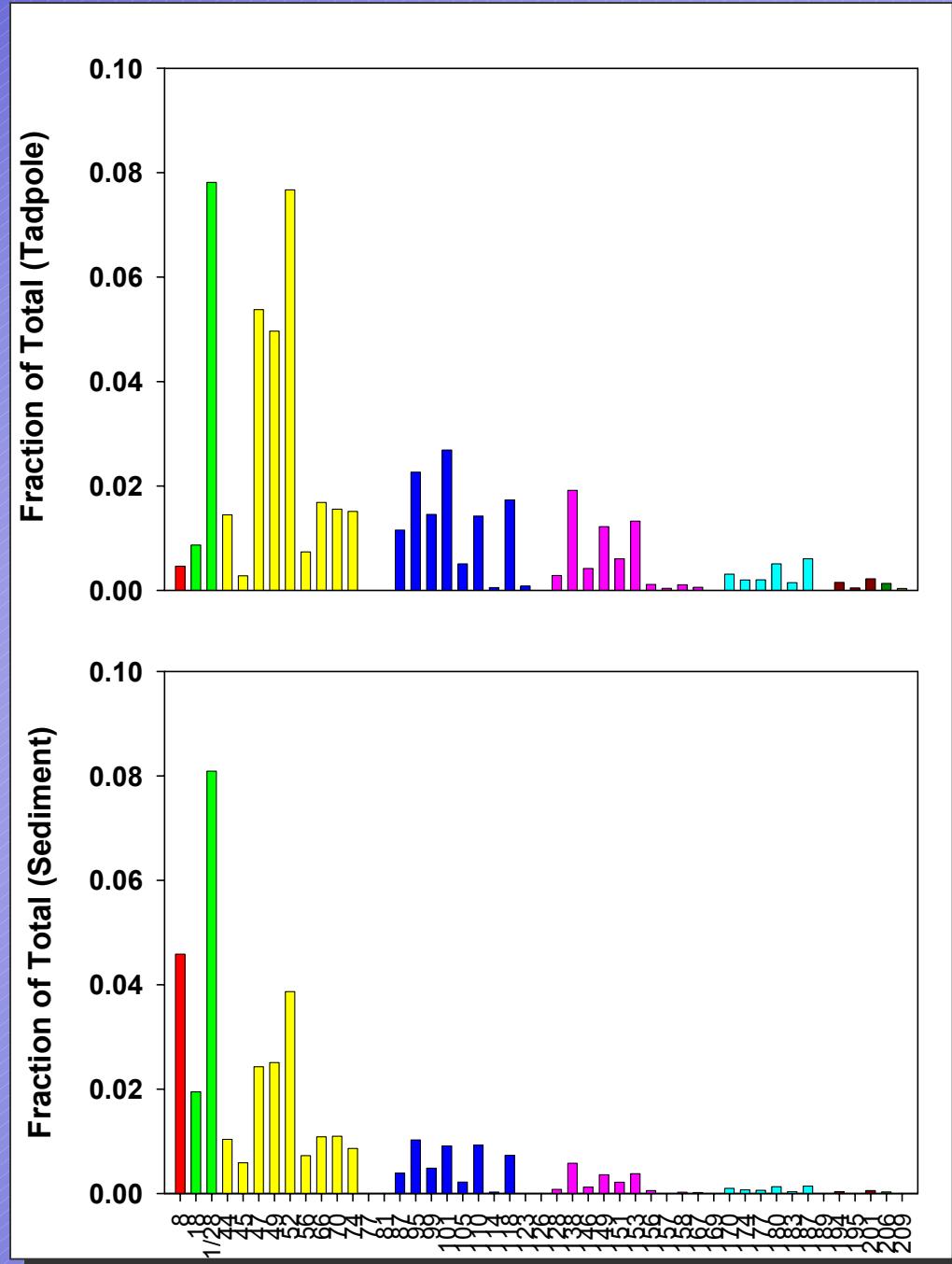
Tadpole Lipid Content vs [PCB]



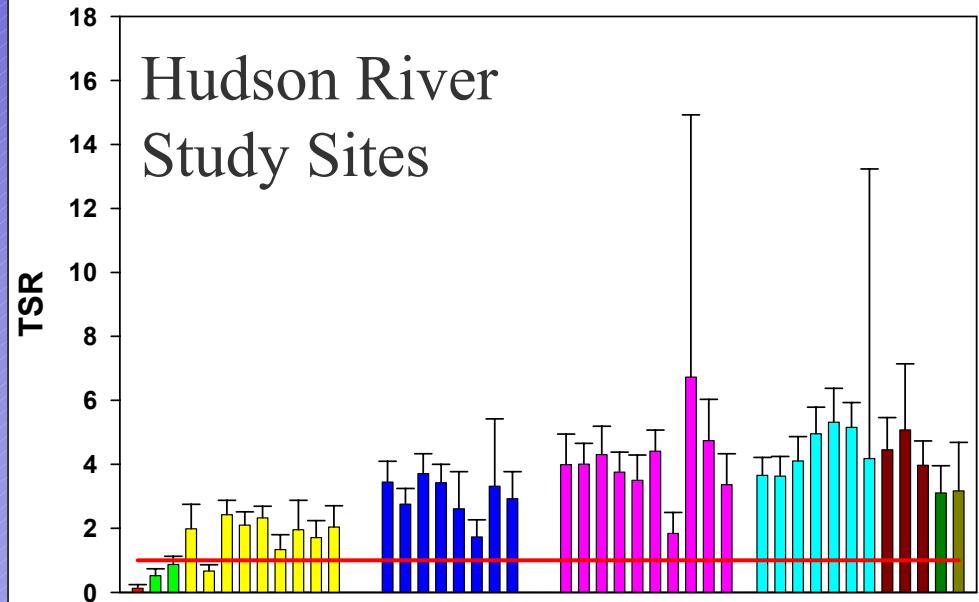
Tadpole : Sediment Ratios (TSRs)

Tadpole PCBs (normalized to total)

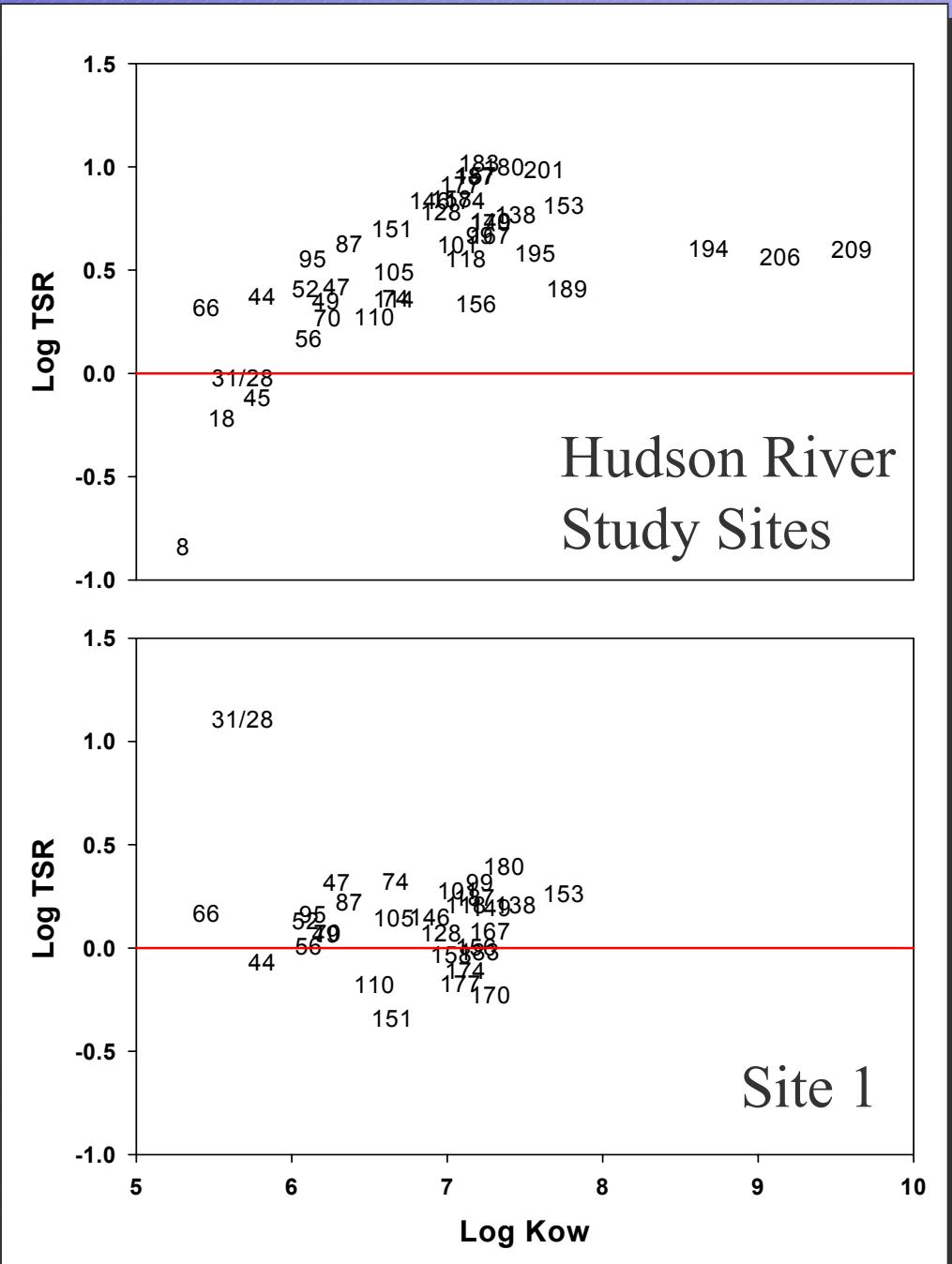
Sediment PCBs (normalized to total)



TSRs

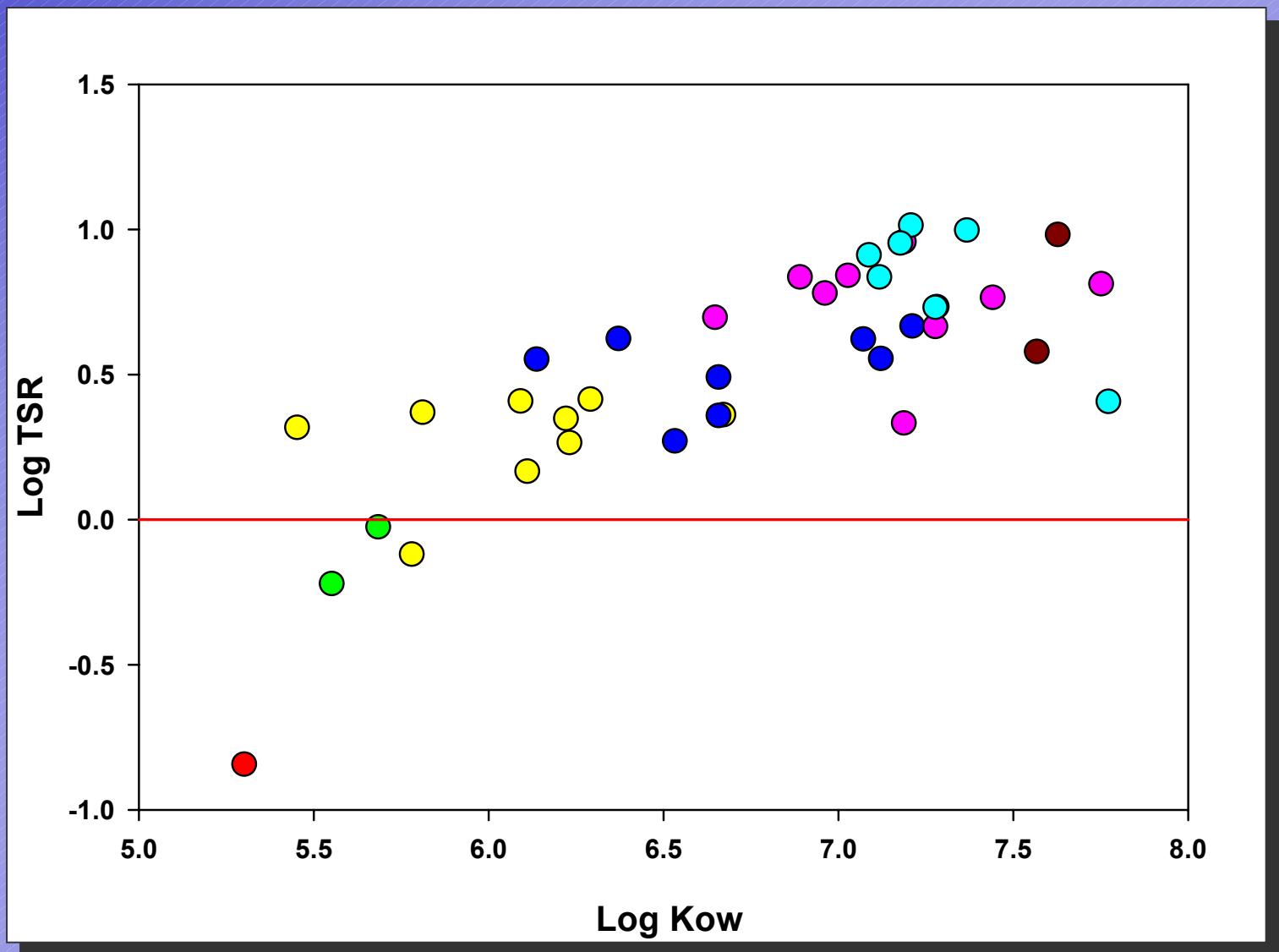


Log Kow vs Log TSR



Study Site Log Kow vs Log TSR

- Di
- Tri
- Tetra
- Penta
- Hexa
- Hepta
- Octa



Conclusions

- Hudson River bullfrog tadpoles are contaminated with PCBs
- Tadpole PCB body burdens and congener distributions reflect sediment PCB loads and composition
- Sediment and tadpole PCB congener distributions varied little within and between study sites
- Reference site sediment and tadpole PCB congener composition differed markedly from study sites
- The majority of sediment PCB congeners are found in greater relative fractions in collocated tadpole tissues

